

## Integrative Medicine Research

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## Commentary

## How do psychological factors influence autonomic responses to acupuncture?



Jungtae Leem\*

Korean Medicine Clinical Trial Center, Kyung Hee University Korean Medicine Hospital, Seoul, Korea

## ARTICLE INFO

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**1. Focal Article**

Chang DS, Kim YJ, Lee SH, Lee H, Lee IS, Park HJ, Wallraven C, Chae Y. Modifying Bodily Self-Awareness during Acupuncture Needle Stimulation Using the Rubber Hand Illusion. *Evid Based Complement Alternat Med* 2013; 2013:849602.

**2. Aim**

To investigate whether modifying bodily self-awareness by manipulation of body ownership and visual expectation would change the subjective perception of pain and autonomic response to acupuncture stimulation.

**3. Design**

The study used a randomized, two-arm, crossover design. Two experiments were designed, with and without visual expectation conditions.

In each experiment, participants experienced synchronous and asynchronous brush stroking sessions in random order.

**4. Setting**

The study was conducted at the Acupuncture and Meridian Science Research Center, Kyung Hee University, 1 Hoegi-dong, Dongdaemun-gu, Seoul 130-701, Republic of Korea.

**5. Participants**

Thirty-one participants (19–29 years of age; 16 males and 15 females) were recruited from the general population through advertisement.

Experiment 1 included 19 participants (M: 9, F: 10); Experiment 2 included 12 participants (M: 7 F: 5).

\* Corresponding author. Korean Medicine Clinical Trial Center, Kyung Hee University Korean Medicine Hospital, 1 Hoegi-dong, Dongdaemun-gu, Seoul, Korea.

E-mail address: [julcho@naver.com](mailto:julcho@naver.com)

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## 6. Intervention

**Experiment 1:** Acupuncture needle stimulation was applied to the real hand. Participants saw the acupuncture needle stimulation applied to the rubber hand in a synchronized and colocalized manner as it was applied to the real hand (visual expectation condition). Participants were told to fixate on the rubber hand and not to look elsewhere.

As seen in Fig. 1, two small paintbrushes stroked the rubber hand and the participant's hidden real left hand as synchronously as possible (synchronous condition) and asynchronously (asynchronous condition).

During the synchronous session the rubber hands illusion (RHI) was successfully evoked and implied disruption of body ownership (disembodiment). During the asynchronous session, participants had a normal sense of body ownership (embodiment).

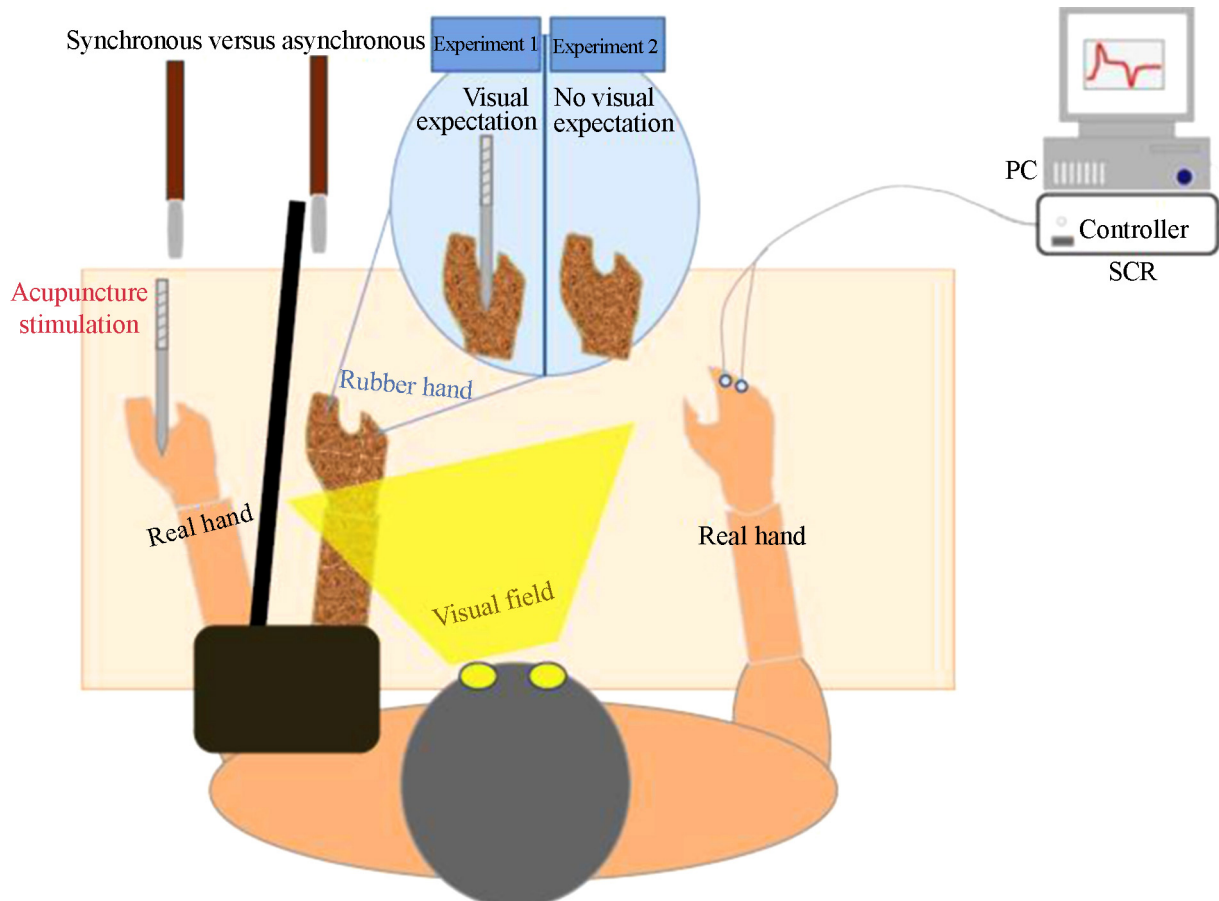
After 300 seconds of brush stroking, an acupuncture needle was applied to the real hand by inserting the needle into the skin using the small tube. The order of synchronous brush stroking and asynchronous brush stroking was randomized. The participants had to wait 10–15 minutes between the two sessions.

**Experiment 2:** The design was almost identical except that participants received no visual feedback (no visual expectation), meaning that they did not know when or where the acupuncture needle would penetrate their real hand.

The participants were told that they would randomly receive either real acupuncture treatment (with needle penetration of the skin) or sham acupuncture treatment (without needle penetration) for each trial.

## 7. Main outcome measures

- (1) Skin conductance response (SCR): Two electrodes were placed on the second and third digits of the left hand on the medial side of the phalanges. Skin conductance was recorded using a galvanic skin response amplifier (GSR Amp ML116; AD Instruments, Bella Vista, Australia) and a high-performance data acquisition PowerLab 8/30 system (ML870; AD Instruments). We assessed score changes that reflected increments or reductions from baseline after acupuncture treatment.
- (2) Rubber Hand Illusion Perception Scale (RHIS)<sup>1</sup>: After finishing each session, participants reported their perception of RHI using RHIS, which includes nine questions.



**Fig. 1 – (from the focal article) Schematic drawing of the experimental setup illustrating the rubber hand illusion with (Experiment 1) and without (Experiment 2) the visual expectation when participants received acupuncture stimulation on their real hand. Two small paintbrushes stroked the rubber hand and the participant's hidden real left hand as synchronously as possible under one condition (synchronous condition) and asynchronously under the other (asynchronous condition). PC, personal computer; SCR, skin conductance response.**

- (3) Self-reported pain scale: evaluated using 100-mm visual analog scale (VAS).

## 8. Main results

### (1) Skin conductance response

The increase in SCR to acupuncture stimulation was significantly higher under the visual expectation condition (Experiment 1) compared with the no visual expectation condition (Experiment 2).

In Experiment 1, the amplitude of the increase in SCR was visibly higher during the synchronous session compared with the asynchronous session.

In Experiment 2, the amplitude of the increase in SCR was lower for the synchronous session compared with the asynchronous session.

### (2) Self-assessment of the RHI

A significant difference was observed in the self-reported RHI questionnaire scores between the synchronous versus asynchronous brush stroking sessions in both experiments as follows:

Experiment 1 (visual expectation condition):  $1.8 \pm 0.2$  versus  $-0.3 \pm 0.3$ ,  $p < 0.001$ .

Experiment 2 (no visual expectation condition):  $1.8 \pm 0.3$  versus  $-0.4 \pm 0.3$ ,  $p < 0.001$ .

### (3) Self-assessment of pain

No significant differences were observed between the synchronous and asynchronous brush stroking sessions in self-reported pain in Experiment 1 or Experiment 2.

Experiment 1 (visual expectation condition):  $4.1 \pm 0.6$  versus  $3.5 \pm 0.6$ .

Experiment 2 (no visual expectation condition):  $2.8 \pm 0.6$  versus  $2.5 \pm 0.6$ .

## 9. Authors' conclusion

Experiments involving illusions of body ownership have made it possible to manipulate different aspects of bodily self-awareness. This study is the first to modify bodily self-awareness and to test psychophysiological responses to acupuncture needle stimulation. This article suggests that sympathetic responses to acupuncture needle stimulation are primarily influenced by visual expectations rather than by modifications of body ownership.

## 10. Address

Dr. Younbyoung Chae, Acupuncture and Meridian Science Research Center, Kyung Hee University, 1 Hoegi-dong, Dongdaemun-gu, Seoul 130-701, Republic of Korea.

E-mail address: [ybchae@khu.ac.kr](mailto:ybchae@khu.ac.kr) (Y. Chae).

## 11. Commentary

In this article, bodily self-awareness was manipulated by two main psychological factors, namely visual expectation and body ownership, which were independent variables in this

research. The authors concluded that autonomic responses to acupuncture stimulation were influenced by visual expectations rather than by modification of body ownership.

In Experiment 1, the participants observed acupuncture stimulation of a rubber hand in the same manner as that for the actual hand. Therefore, the participants of Experiment 1 had visual expectations. However, the participants of Experiment 2 did not receive any visual feedback; therefore, they had no visual expectations. Body ownership is defined as the sense that the body or body part belongs to oneself. The sense of embodiment is the experience of being within the borders of one's body. These senses can be experimentally modified, most commonly by using the rubber hand illusion (RHI). In RHI,<sup>2</sup> individuals perceive a prosthetic hand as their own hand by observing a full-screen view of synchronous touches applied to the rubber hand. The real hand is hidden behind a screen, giving the perception of touch from the rubber hand and an ownership of the artificial hand.

In this study, subjective pain perception was not different based on visual expectations and synchronization. A recent study has shown that RHI does not induce analgesia,<sup>3</sup> and the results of the current study were consistent with this finding. However, the Rubber Hand Illusion Perception Scale (RHIS) was higher in the synchronous group. The authors state that synchronous brushing evoked successful body ownership and embodiment of the rubber hand, while inducing a disruption of body ownership and disembodiment for the real hand.

There were differences in autonomic responses between the experiments. Most important, the increase in skin conductance response (SCR) to acupuncture was higher in the presence of visual expectations (Experiment 1) than in the absence of visual expectations (Experiment 2), probably because vision plays an important role in bodily self-awareness and body ownership, as mentioned previously.<sup>4</sup> Next, in Experiment 2 (no visual expectation condition), the amplitude of the SCR increase was lower for the synchronous session compared with the asynchronous session, suggesting that sympathetic activation in response to acupuncture needle stimulation decreased in the disembodied condition. The authors speculate that psychologically induced limb-specific body disruption diminished the autonomic response to acupuncture stimulation, consistent with previous results.<sup>5</sup> However, in Experiment 1 (visual expectation condition), the amplitude of the SCR increase was higher during the synchronous session, which seems to be the opposite result. The authors suggest that participants might already have allowed the incorporation of the artificial body part into their "self-representation," and watching the process of acupuncture needle insertion exhibited greater sympathetic activation to acupuncture stimulation. However, the possibility that acupuncture needles enhance the fear of pain cannot be excluded. Therefore, the autonomic response might not be specific to acupuncture sensations.

There is another interesting study concerning the psychological aspects of acupuncture and physiological responses.<sup>6</sup> Lee et al<sup>6</sup> compared real acupuncture (REAL) and a phantom acupuncture (PHNT) device. In the PHNT group, the acupuncturist did not provide any tactile input to the participants, and only moved their hands toward the acupoint. A video-clip that was recorded in advance and created the illusion

of needle insertion and stimulation was replayed during the PHNT session. The authors posed several questions to the participants about the credibility of the PHNT device after completion of the experiments and divided the participants into a PHNT credible group (PHNTc) and a PHNT noncredible group (PHNTnc) according to the responses. The authors compared SCR between the REAL and PHNT groups and between the PHNTc and PHNTnc groups. SCR significantly increased in the REAL group only, but not in the PHNT group, regardless of their perception of PHNT acupuncture as real or not. There were no differences in SCR between the PHNTc and PHNTnc groups. They suggested that only the somatosensory component of acupuncture increased sympathetic tone and that SCR does not increase significantly without skin penetration.

In RHI research, SCR was increased in all experiments, whereas in PHNT research, SCR was increased only in the REAL group. Therefore, it can be speculated that visual expectations combined with tactile stimulation enhance autonomic responses. However, without tactile stimulation, visual expectations cannot induce significant SCR. In the RHI article, they examined only SCR. However, there are various other autonomic responses such as heart rate, respiratory rate, and pupil size, among others; therefore, each of the various autonomic responses should be researched to investigate the function of visual expectations and body ownership in the modification of bodily self-awareness.

## Conflict of interest

None declared.

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